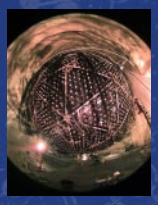
NUCLEAR PHYSICS

The mission of the Nuclear Physics (NP) program is to foster fundamental research in nuclear physics that will provide new insights and advance knowledge on the nature of matter and energy and develop the scientific knowledge, technologies, and trained workforce that are needed to underpin DOE's missions for nuclear-related national security, energy, and environmental quality.

RECENT SCIENTIFIC ACHIEVEMENTS

A New Form of Matter Discovered
The universe may have begun as a "perfect" liquid, not a gas. Researchers have evidence for an extraordinary new state of hot, dense matter that behaves like a liquid with little viscosity rather than a fiery gas.

Neutrinos and the Core of the Sun
The solution to the 30-year-old mystery of missing solar neutrinos lies not with the Sun, but with the neutrinos, which change identity as they travel from the core of the Sun to the Earth.



Strange Quarks Influence the Proton Structure
Although strange quarks are not permanent residents of the proton, researchers discovered these particles may contribute to a proton's charge distribution and its magnetization.

Unique Technique Aids Hunt for Atomic Nucleus Size
Researchers have developed revolutionary techniques to make the first model-independent measurement of the radius of the ^{6}He nucleus and find it to be two trillionths of a millimeter.

Nuclear Reaction Rates Determine the Observational Reach of Gamma-Ray Observatories
Measurements of the production and destruction of radioactive nuclei establish the maximum distance that a satellite gamma-ray observatory can detect exploding stars.

Advances in Superconducting Radio Frequency
Large crystal superconducting niobium has been used to develop cost-effective, high performance accelerating cavities for next-generation particle accelerators.

MAJOR USER FACILITIES

The Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory is the world's premier facility for studying new states of matter not in existence since microseconds after the Big Bang and for studying the spin structure of the proton using polarized protons.

The Continuous Electron Beam Facility (CEBAF) at Jefferson Laboratory is the world's leading facility for studies of the internal quark structure of the nucleon with electron beams and is a world-leader in the research and development of superconducting radio-frequency technologies.

The Argonne Tandem Linac Accelerator System (ATLAS) at Argonne National Laboratory and the Holifield Radioactive Ion Beam Facility at Oak Ridge National Laboratory are low-energy National User Facilities that allow important advances in understanding energy production in stars, heavy element formation, and supernovae explosions through nuclear structure and astrophysics studies.